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(54) **HIGH FLOW RATE SAMPLE FLOW PATH ASSEMBLY FOR ELECTRONIC GAS LEAK DETECTORS**

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(51) **Int. Cl.**[7] **G01N 19/10**
(52) **U.S. Cl.** **73/23.2**
(58) **Field of Search** .... 73/23.2, 23.42, 73/40.7, 863.03, 863.83, 40.5 R

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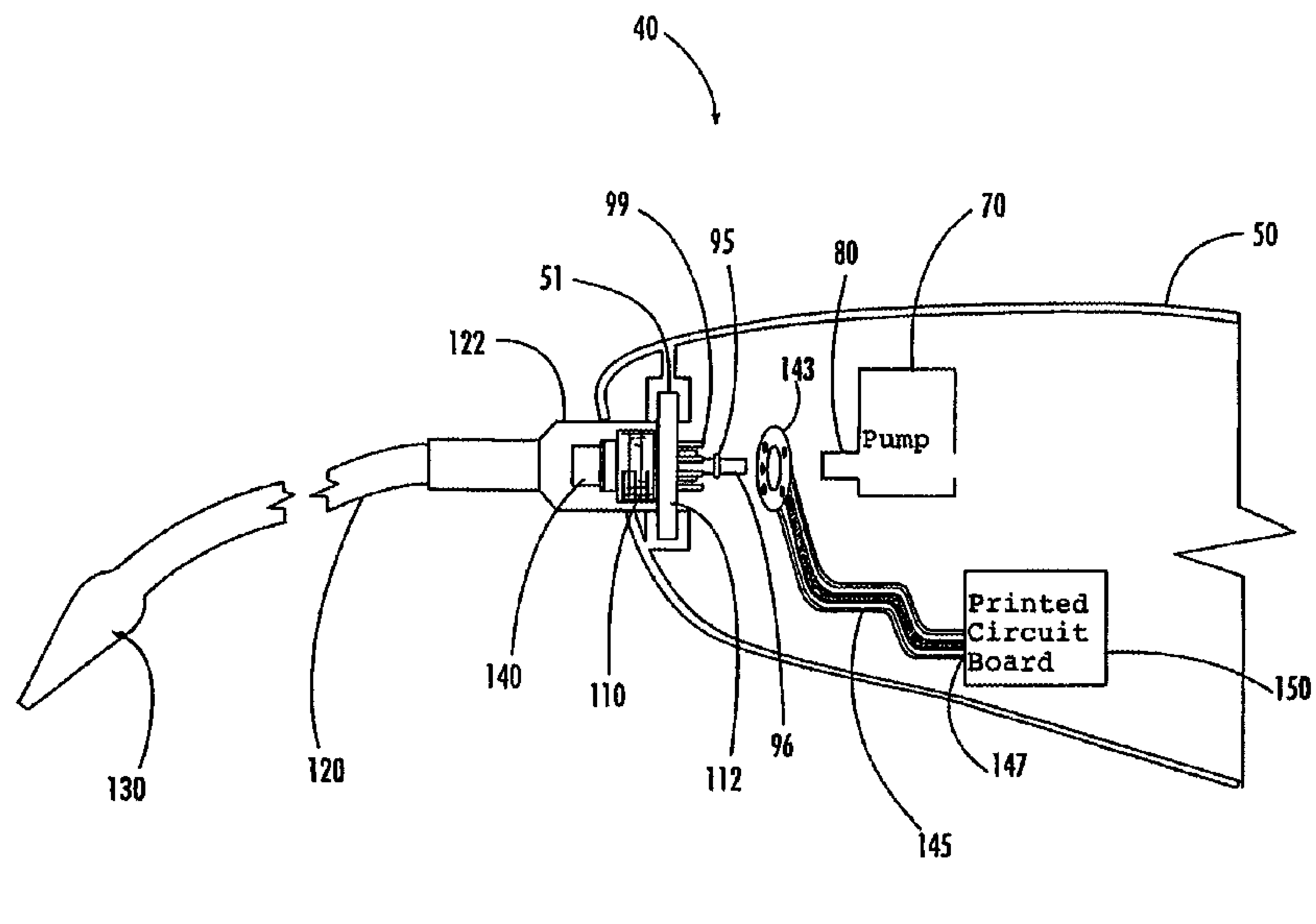
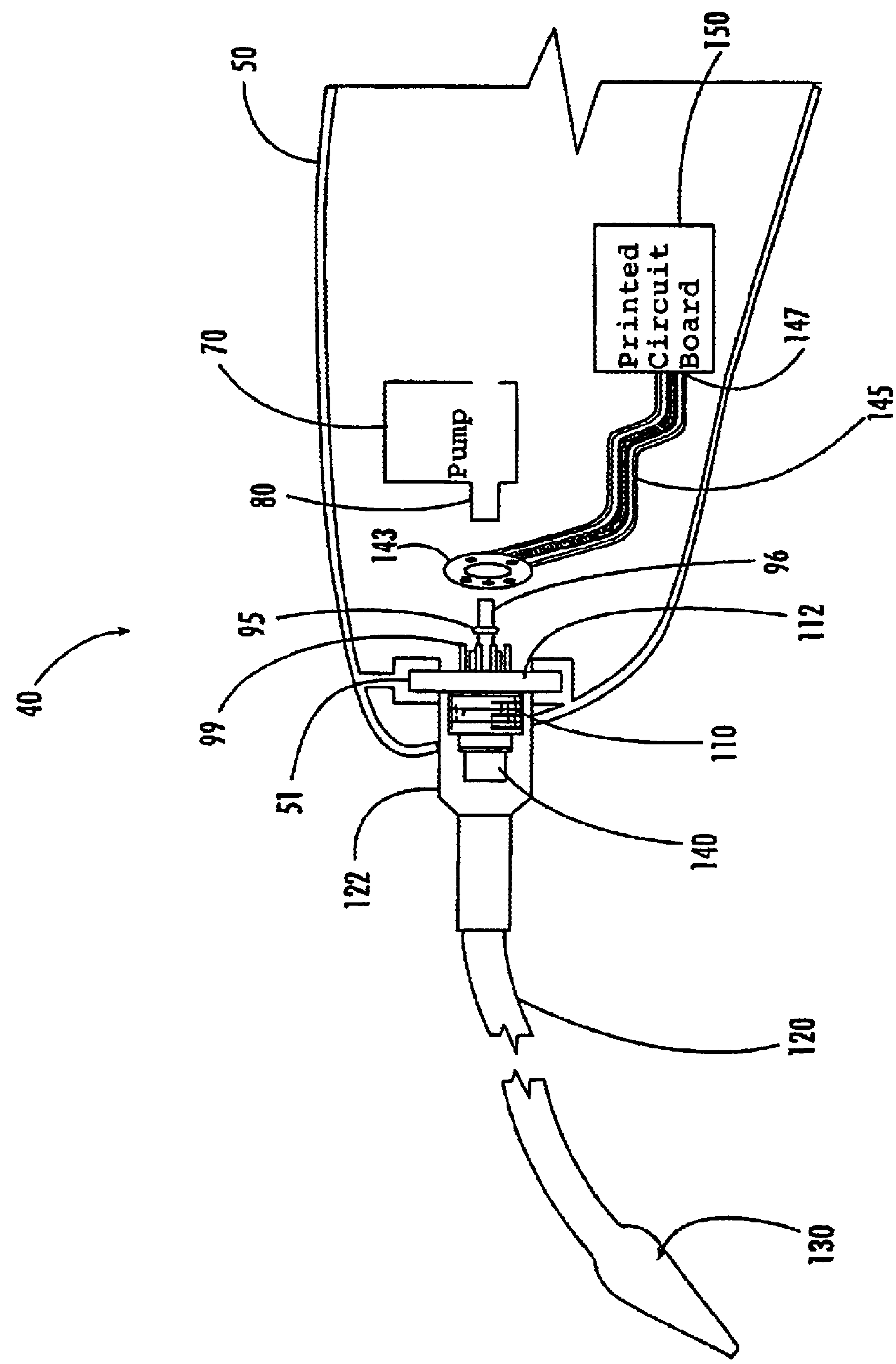
(57) **ABSTRACT**

A gas detector, as useful for conducting refrigerant fluid leak detection, having a housing, a probe and a sample flow path assembly capable of providing a sample air flow rate to a sensing device in excess of 300 SCCM. The sample flow path assembly also provides the gas detector with a short signal path between the sensing device and a printed circuit board within the housing, an efficient sample path, and ready access to and easy replacement of the sensing device as well as of the probe, making the gas detector generally more reliable and cost effective. The sample path assembly requires a simple method of construction and sensing device replacement thereby reducing the difficulty and the time required for manufacturing the sample flow path assembly and, ultimately, reducing the cost of manufacturing the electronic gas leak detector.

21 Claims, 10 Drawing Sheets




40
50
70
Pump
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140
Printed Circuit Board
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145
150
120
130

FIG. 1.

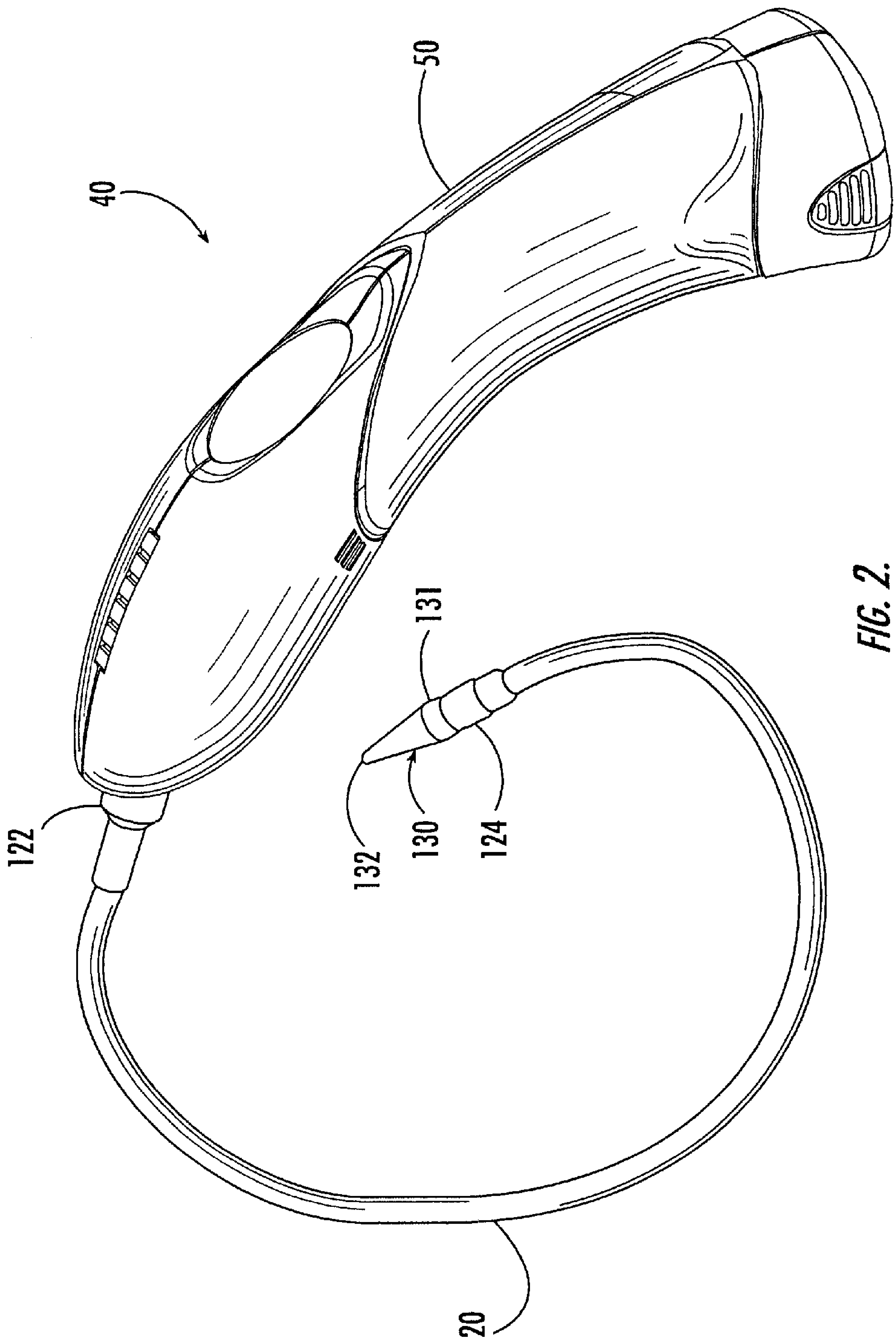

FIG. 2.

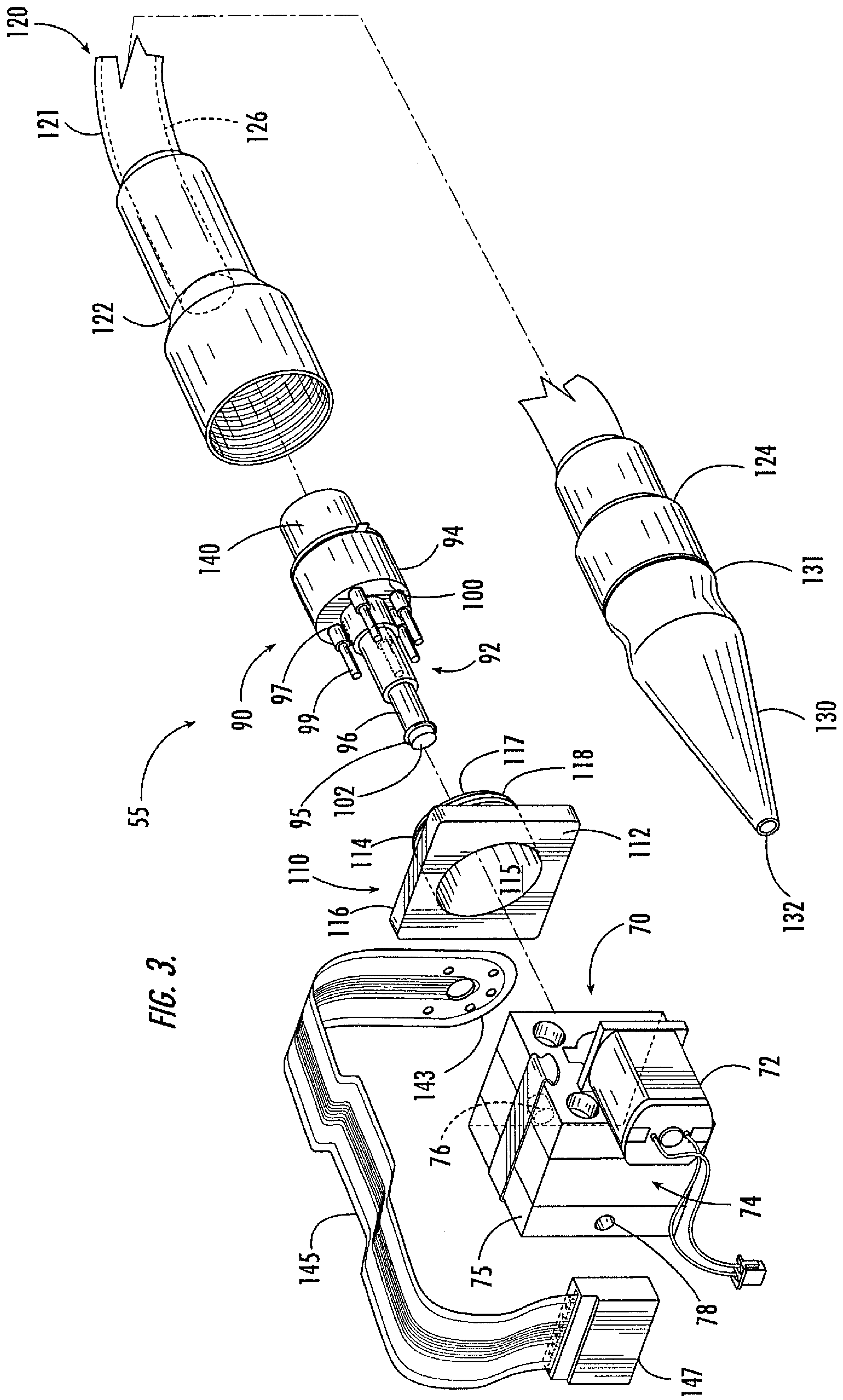
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FIG. 3.

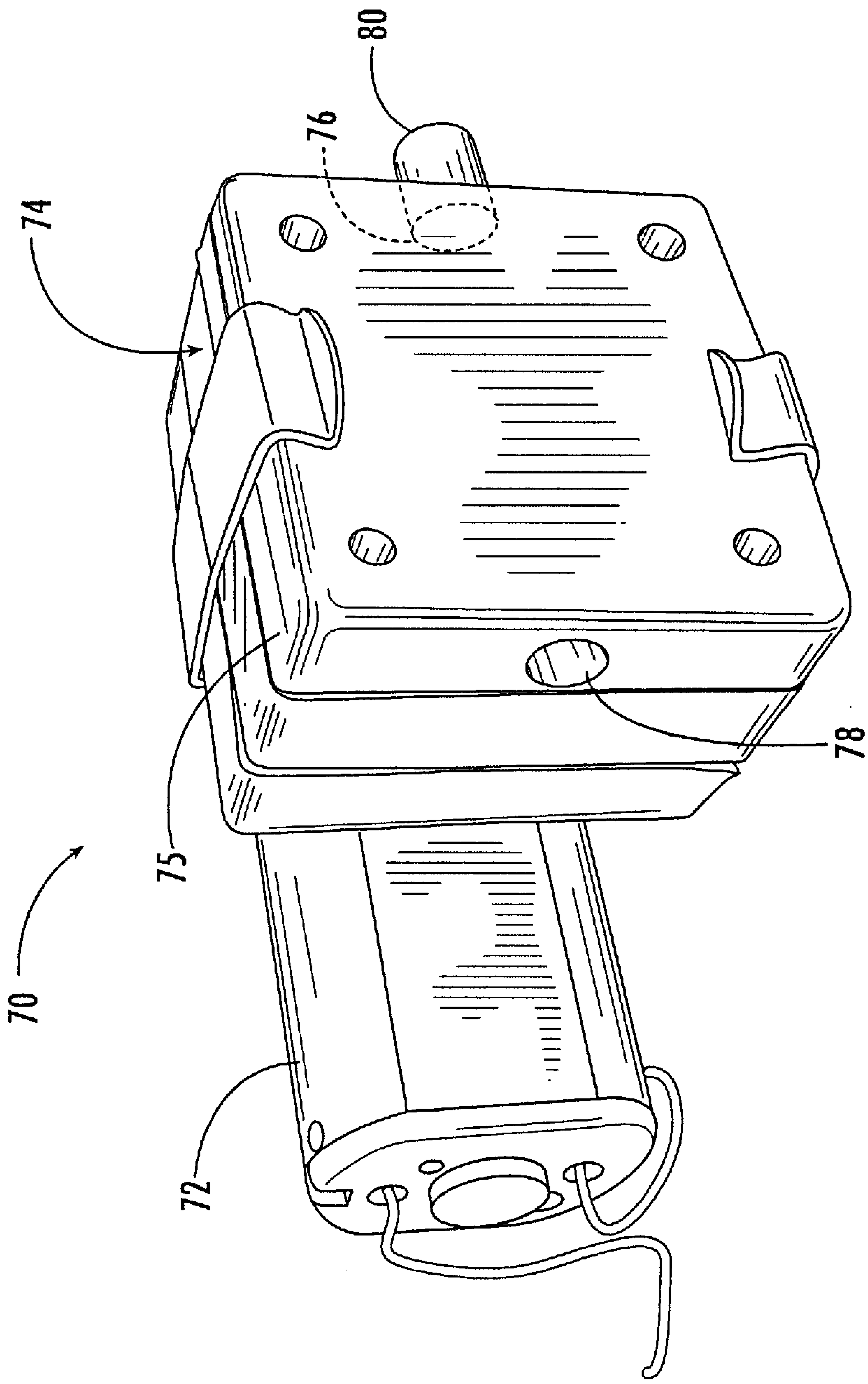

FIG. 4.

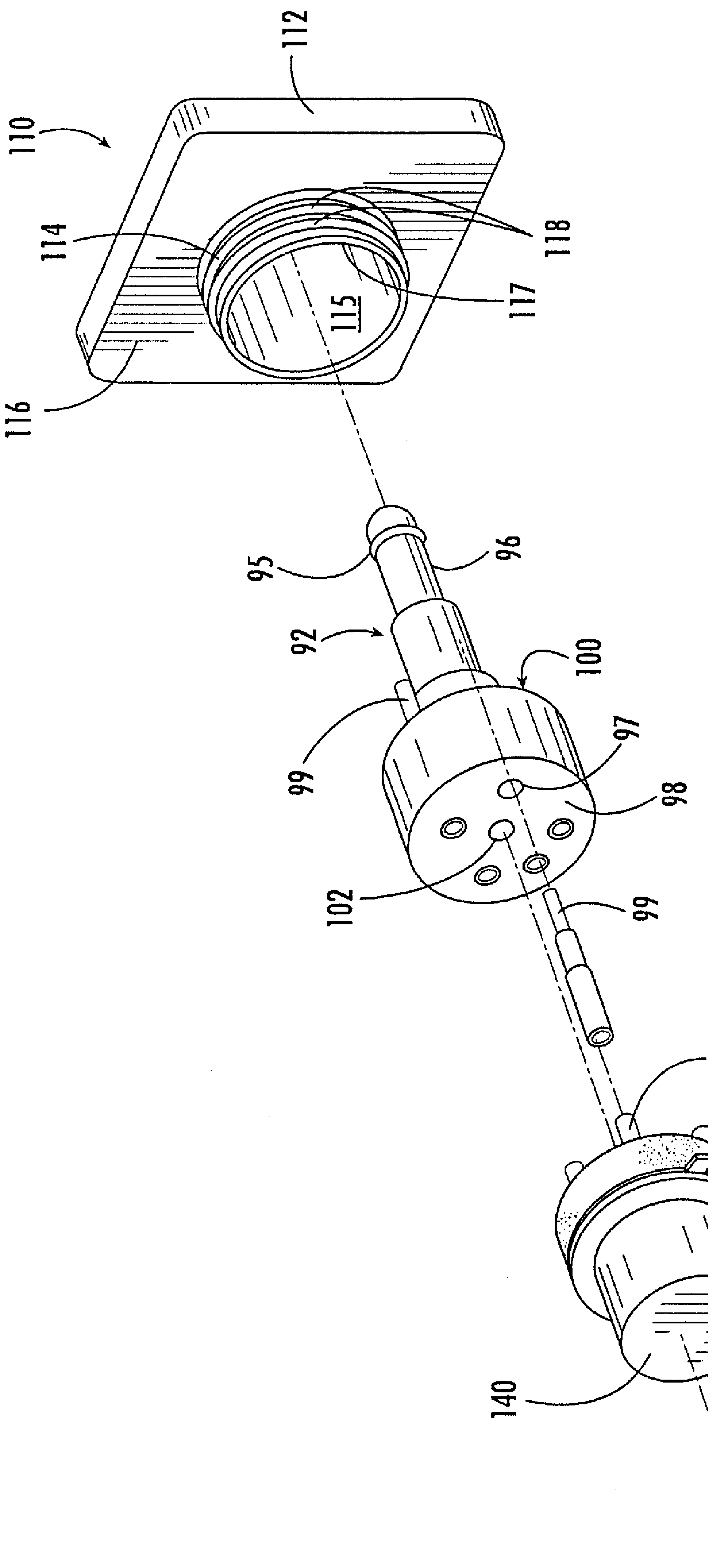

FIG. 5.

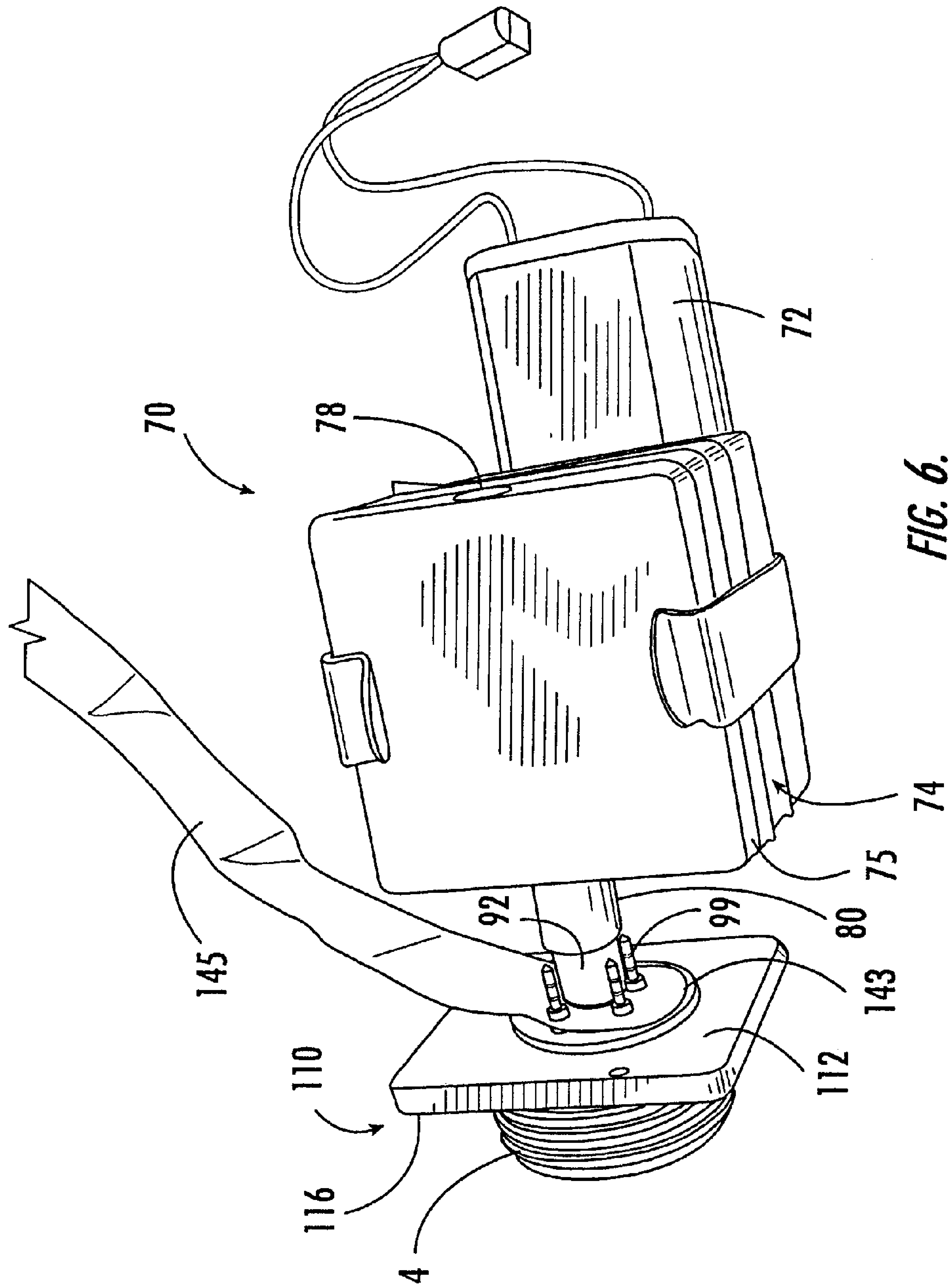

FIG. 6.

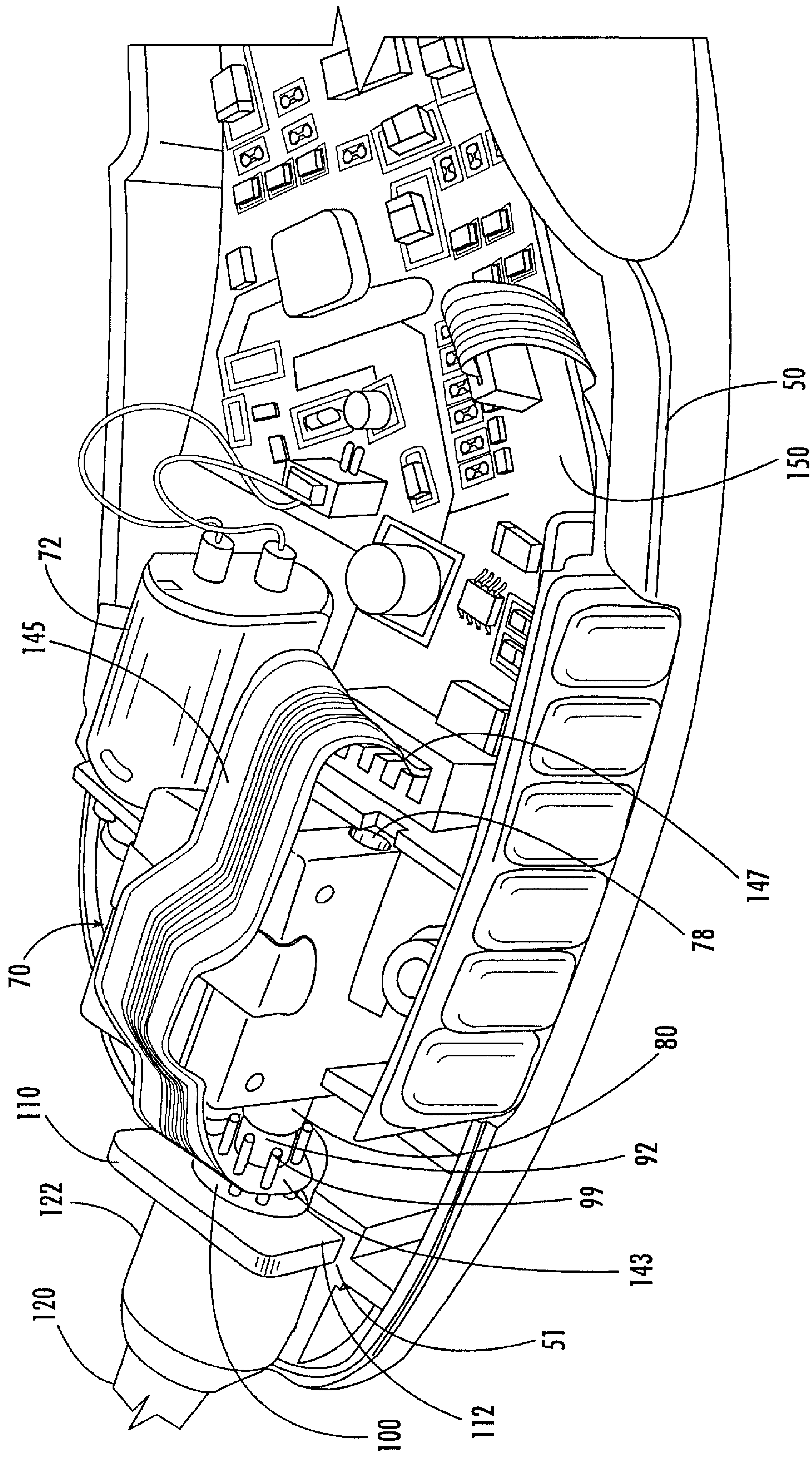

FIG. 7.

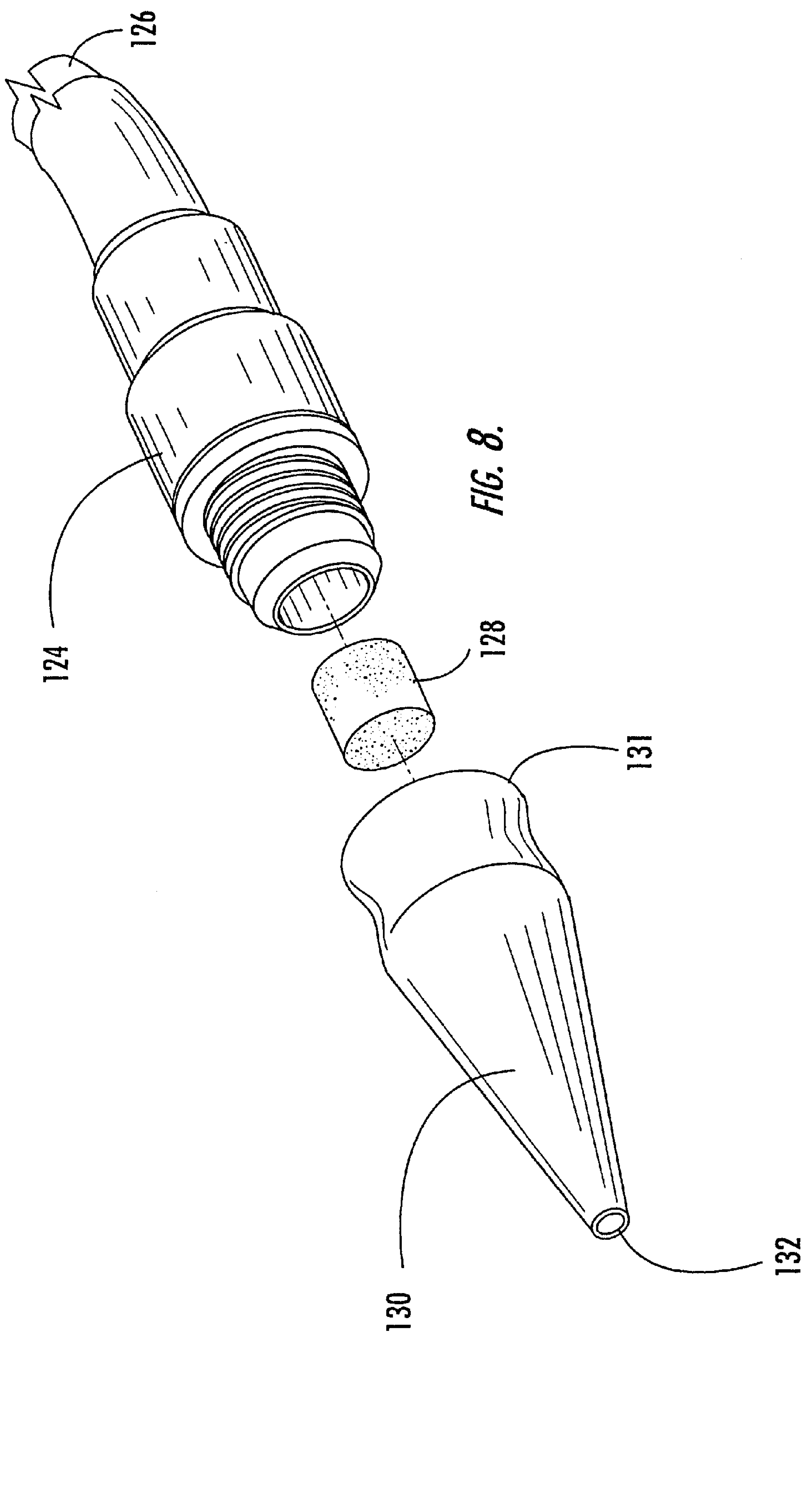

FIG. 8.

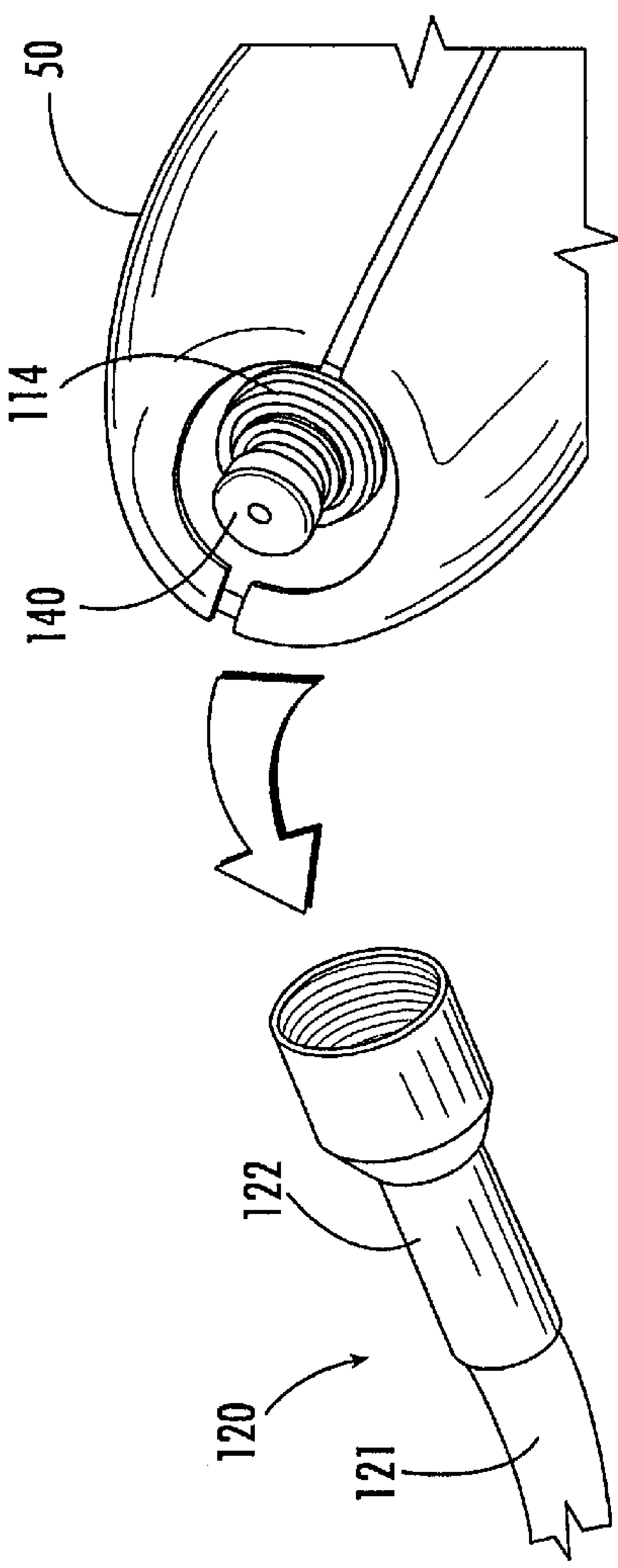

FIG. 9a.

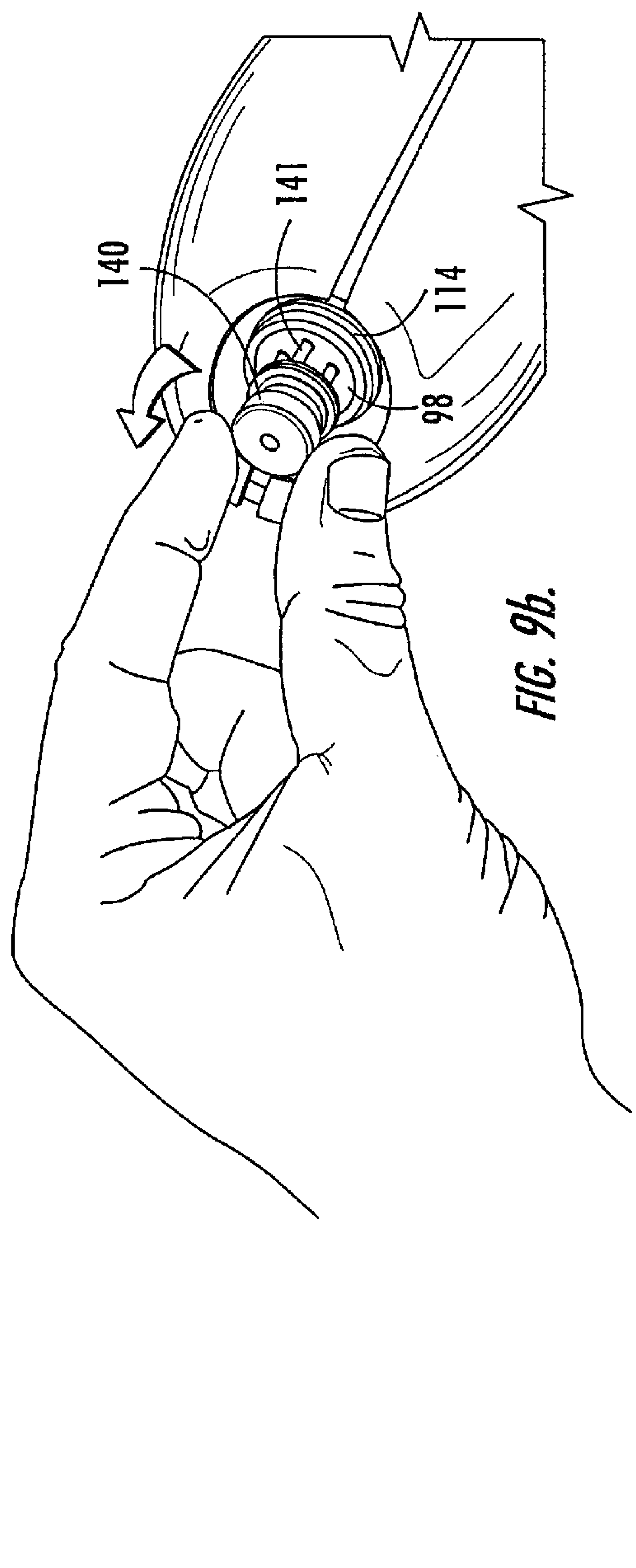

FIG. 9b.

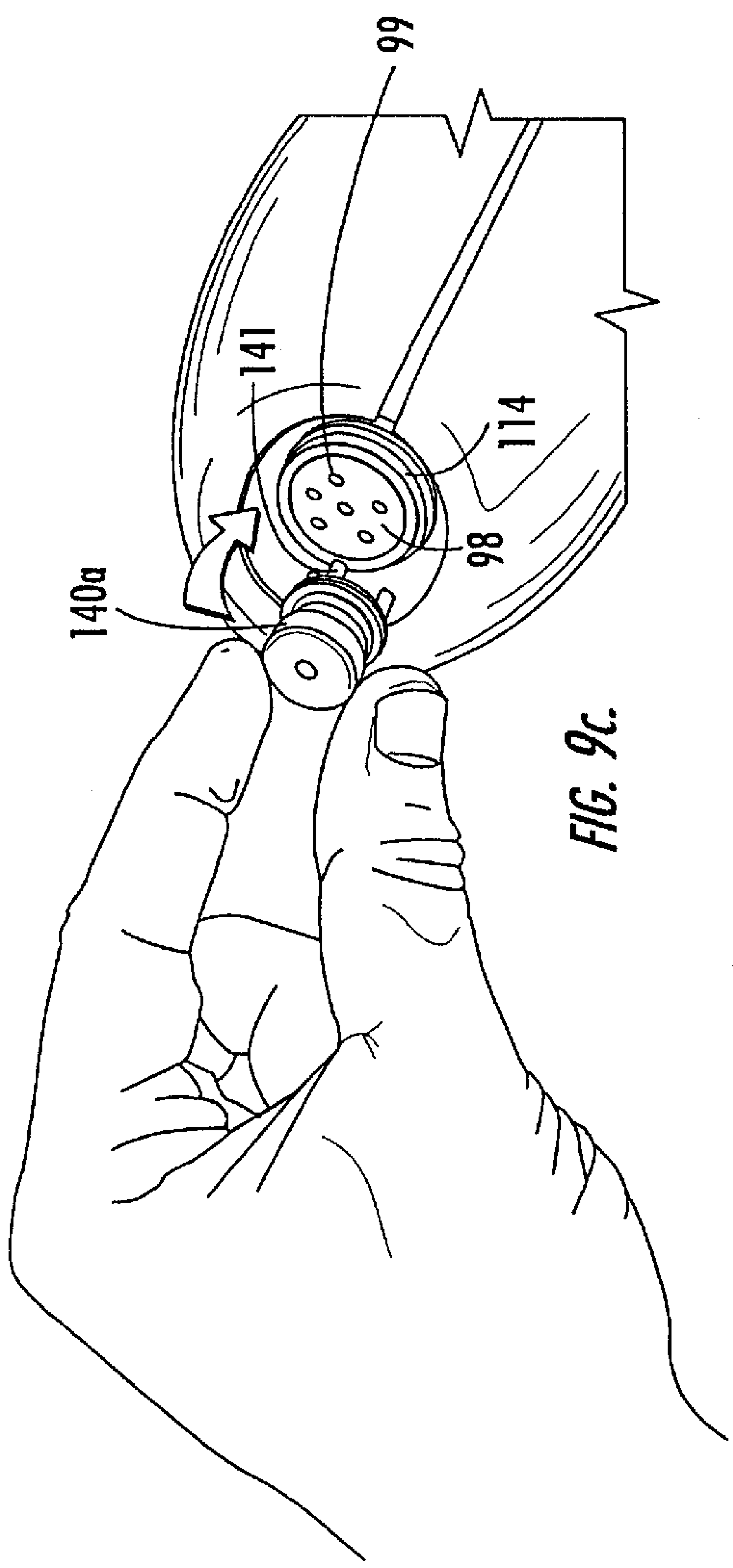

FIG. 9c.

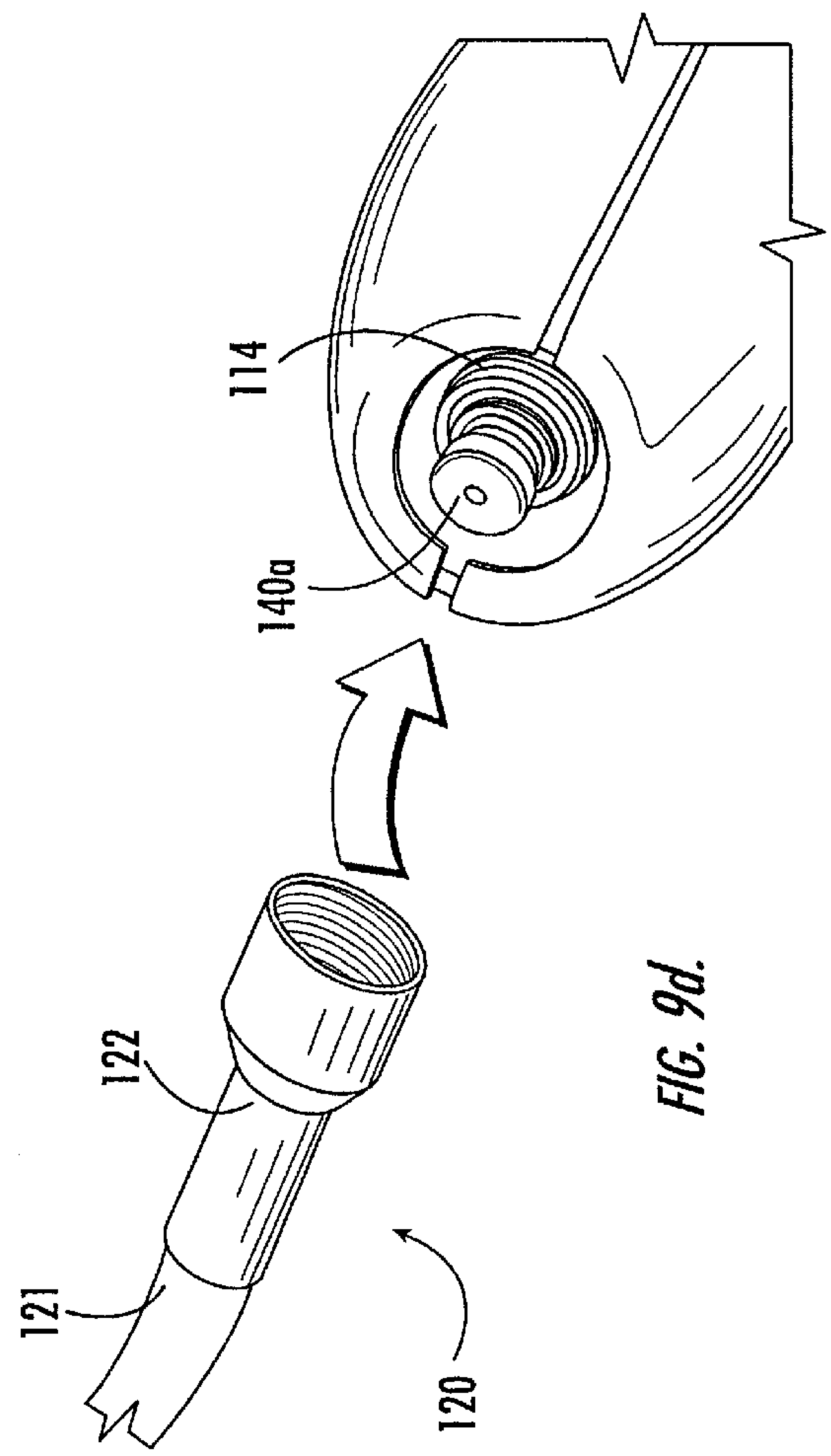

FIG. 9d.

HIGH FLOW RATE SAMPLE FLOW PATH ASSEMBLY FOR ELECTRONIC GAS LEAK DETECTORS

BACKGROUND OF THE PRESENT INVENTION

1. Field of the Present Invention

The present invention relates generally to the field of gas detectors, and, in particular, to the art of supplying sample air to one or more heated electrode sensing devices to detect halogenated refrigerants.

2. Background Art

Electronic refrigerant leak detectors typically include a power supply, such as a replaceable or rechargeable battery, one or more sensing devices (sensors), a printed circuit board and a sample path assembly for drawing air into or across the sensing device. The sample path of most electronic refrigerant leak detectors start at a flexible hollow tube of varying length called a goose-neck probe. The free end of the probe is positioned where the operator wants to take an air sample. The sample of air is drawn into the free end of the probe, through a filter, and then across or past the sensing device before being exhausted from the detector. The detector generally has some means for drawing the sample of air along the sample path, for example a fan or pump.

Currently available electronic refrigerant leak detectors include the "D-TEK," manufactured by Leybold-Inficon, headquartered in East Syracuse, N.Y.; "The Informant," manufactured by Bacharach, headquartered in Pittsburgh, Pa.; and the H10Xpro "Top Gun," manufactured by Yokogawa Corporation of America, headquartered in Newnan, Ga. Each detector has a gooseneck probe extending some length from the detector body and a means for drawing an air sample through the probe. The air sample is drawn through or across the sensor which is electronically connected to a printed circuit board that is disposed within the interior of the detector body.

The D-TEK uses a centrifugal fan surrounded by a shroud to draw air through a probe. One end of the flexible goose-neck probe is glued to the shroud while the free end extends about 16 inches from the detector body. A sensor is located within the free end of the flexible probe. The fan draws the air sample through the free end of the probe, across the sensor, through the remaining length of the probe and into the shroud before it is exhausted from the fan. Signals from the sensor are transmitted to the printed circuit board via electrical wires inserted into the probe and traveling the length of the probe from the sensor to the printed circuit board. The wires are inserted through a rubber plug that seals the shroud where the probe is attached so that leaks around the wires are minimized. A probe tip, attached to the free end of the flexible probe, encloses the sensor. The sample flow rate across the sensor is approximately 35 standard cubic centimeters per minute (SCCM).

Unfortunately, this construction has several disadvantages concerning the manufacture and use of the detector. The relatively low flow rate across the sensor results in a low sensor sensitivity, a longer response time and a longer clearing time (the amount of time required to purge the sample path assembly and the sensor of previously analyzed gas so that a new sample can be taken and analyzed). The flexible probe is glued to the fan shroud, which makes the replacement of a damaged flexible probe difficult and time consuming. The wires connecting the sensor to the printed circuit board are inside the flexible probe, and hence, obstructs the flow path between the probe tip and the fan, potentially resulting in an unquantifiable and unpredictable resistance to the flow of the air sample through the flexible probe, ultimately causing an inconsistent sample flow across the sensor from one use to the next and from one detector to the next. Besides obstructing the flow path, the length of the wires connecting the sensor and the printed circuit board increases the electrical resistance of the wires, increasing demand on the battery and reducing the operating time of the detector without changing batteries or recharging the existing battery. Finally, inserting wires through the small diameter flexible tubing of the flexible probe, sealing the flow path around the wires, and gluing the flexible probe to the fan shroud all increase the difficulty and time required to manufacture the sample path assembly of the detector and to replace the probe or fan if either are damaged.

Like the D-TEK, "The Informant" uses a fan surrounded by a shroud to draw air through a 20 inch flexible probe. One end of the flexible probe is glued to the shroud and the free end is covered by a probe tip. The sensor is located within free end of the flexible probe. The sensor is covered by the probe tip and a filter. Wires connecting the sensor to the printed circuit board are routed through the shroud and into the interior of the flexible probe. A flexible sealant is used to seal the shroud and flexible probe around the wires. The typical flow rate is approximately 50 SCCM. The Informant has many of the same disadvantages as the D-TEK. In addition, the use of a flexible sealant increases the time for manufacture because the sealant must be "cured" to create a usable seal.

The "Top Gun" detector offers a different approach to constructing a sample path assembly for an electronic refrigerant leak detector. The sensor is connected directly (i.e., is soldered) to the printed circuit board, eliminating the wires found in the flow paths of the D-TEK and The Informant. A flexible probe is approximately 16 inches long and is removably attached to the detector body. A rotary vane pump draws air through the flexible probe at a flow rate of approximately 250 SCCM. The air sample travels through the flexible probe, into the inlet of the rotary vane pump, through the pump to the outlet of the pump, and through a 'T' split before encountering the sensor. The air sample from the outlet of the pump is split into two paths at the 'T' split—one path is exhausted from the detector and one path continues to the sensor. Thus, while the flow rate through the flexible probe and rotary vane pump is about 250 SCCM, the actual flow rate of the air sample across the sensor is considerably less and is approximately equivalent to the flow rate of the air sample across the sensors in the D-TEK and The Informant.

The removable flexible probe of the Top Gun, which makes replacement easy, is advantageous over the D-TEK and the Informant. Furthermore, unlike the D-TEK and The Informant, there are no wires traveling the length of the probe to connect the sensor to the printed circuit board. This results in a reduced demand on the battery and an unobstructed flow through the flexible probe. Unfortunately, however, the construction of the sample flow path assembly of the Top Gun presents other disadvantages, most notably the inaccessibility of the sensor, which is fixedly attached to the printed circuit board located inside the detector. This inaccessibility makes replacement of the sensor extremely difficult. Another disadvantage is the placement of the sensor on the outlet side of the pump which introduces potential mixing problems associated with the air sample within the pump, and an increase in the clearing time. Further, because of the flow split, the increased flow rate through the flexible probe results in an increased demand on the battery by the pump without an appreciable increase in sensor sensitivity. The reduced flow rate across the sensor is a necessary component of the "Top Gun" design. Otherwise, the sensor may be damaged if subjected to the full, high, flow rate. Finally, the additional tubing within the detector body required for the 'T' split increases the number of steps needed to manufacture the flow path assembly, thereby increasing the difficulty and time required.

For greatest detector efficiency, the sensitivity of the sensing device (sensor) must be maximized to an optimum level, the response time of the sensing device should be minimized, and the time needed to clear the detector of already sampled gas (the clearing time) must be minimized, all while maintaining a reasonable demand on the power supply (usually measured in terms of battery life). One way to maximize the sensitivity of the sensing device is to increase the flow rate of the air sample flowing across or past the sensing device. The clearing time can be minimized by shortening the sample path between the probe tip and the sensing device and/or increasing the flow rate so the sampled air is exhausted from the detector more quickly. The response time may be minimized by increasing the flow rate of the air sample or shortening the signal path between the sensing device and the electronic circuit. Battery life may be maintained in a variety of ways, including shortening the signal path between the sensing device and electronic circuit, thereby reducing the resistance losses of the wires connecting the sensing device to the electronic circuit, or by reducing the demand placed on the battery by the pump or the fan, either by operating at a lower flow rate or providing a more efficient sample path.

Thus, mindful of the disadvantages of many of the currently available electronic refrigerant leak detectors, a need exists for a gas leak detector that has a sample flow path that maximizes sensing device sensitivity, minimizes respond time, and minimizes clearing time, all while maximizing battery life and reducing manufacturing difficulty and time.

SUMMARY OF THE INVENTION

Briefly summarized, the present invention relates to a sample flow path assembly for use in a gas detector that is capable of sensing the presence of at least one predetermined gas and that has a temperature controlled sensing device, a bias current controlled sensing device, or a combination thereof. The sample flow path assembly includes a means for generating a sample air flow past the sensing device at a flow rate in excess of about 300 SCCM and means for conducting the sample air flow past the sensing device.

The means for generating a sample air flow is a pump that has an inlet port and an outlet port. The pump is located within a body of the gas detector. The means for conducting the sample air flow past the sensing device includes a socket connected to the inlet port of the pump, a collar located at one end of the housing and surrounding the socket, and a probe attached to the collar whereby the probe extends beyond the housing of the detector to open to the surrounding environment. The sensing device is disposed upon and supported by the socket such that the sensing device is disposed between the probe and the pump. A flexible interconnect connects the sensing device to a printed circuit board. The pump motor may be electrically connected to the printed circuit board and supplied DC power, preferably by a battery.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features, embodiments, and advantages of the present invention will become apparent from the following detailed description with reference to the drawings, wherein:

FIG. **1** is a diagrammatic view of the sample flow path assembly embodied by the present invention;

FIG. **2** is a perspective of a gas detector using the present invention;

FIG. **3** is an exploded view of the sample flow path assembly embodied by the present invention with the sensing device being shown disposed with the sample flow path;

FIG. **4** is a perspective of the pump shown in FIG. **3**;

FIG. **5** is an exploded view of the collar and socket components and the sensing device shown in FIG. **3**;

FIG. **6** is a perspective of the internal subassembly of the sample flow path assembly;

FIG. **7** is a cut away view of a gas detector showing the relative placement of the components of the present invention within and without the detector body;

FIG. **8** is an exploded view of the probe and probe tip portion shown in FIG. **3**; and

FIGS. **9***a*–**9***d* are sequential views of a method to replace the sensing device disposed within the sample flow path assembly embodied by the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An electronic gas leak detector **40** has a body **50**, a sample flow path assembly **55**, a printed circuit board **150**, control apparatus (not shown) and a power supply (not shown). Referring now to the drawings, in which like numerals represent like components throughout the several views, the sample flow path assembly **55**, has an internal subassembly, comprising a pump **70**, a socket **90**, a collar **110**, and a flexible interconnect **145**. The sample flow assembly **55** also includes a sensing device **140** and a probe **120**.

Referring to FIG. **4**, the pump **70** is a diaphragm pump suitable for pumping gases at unrestricted flow rates in excess of 400 SCCM. The pump **70** includes a motor **72** attached to a pump body **74**. Air enters the pump body **74** through an inlet port **76** disposed on a manifold **75** and exits the pump body **74** through an outlet port **78** disposed on the manifold **75**. In the present invention, the inlet port **76** and the outlet port **78** are located on opposite sides of the manifold **75**. This construction results in a direct sample flow path to the inlet port **76** of the pump **70** when the pump **70** is positioned within the body **50** of the detector **40**. This direct path eliminates the necessity of lengthy runs of tubing inside the body **50** of the detector **40**, thereby creating a more efficient flow path. Further, the placement of the inlet and outlet ports **76**, **78** on opposite sides of the manifold **75** creates a more compact unit so that the pump **70** can be easily installed within the body **50** of the detector **40**, as shown in FIGS. **6** and **7**. In a preferred embodiment, the pump **70** is a diaphragm micro-pump manufactured by Anglo Nordic Burner Products Ltd. of West Molesey, Surrey, England, identified as part number AN7400101, which is capable of unrestricted air flow rates up to 800 SCCM. The factory provided manifold of the Anglo Nordic pump, which has the inlet and outlet ports on its outer face, has been modified such that the inlet port **76** is on one side of the manifold and the outlet port **78** is on the opposite side of the manifold **75**. A duct **80** having a circular cross-section projects outwardly from the inlet port **76**.

The socket **90** includes a stem **92** molded to a body **94**. The stem **92** is formed from a hollow cylinder. A first stem segment **96** opposite the body **94** has an outer diameter smaller than that of the portion of the stem **92** that is molded to the body **94** of the socket **90**. The first stem segment **96** is of the size such that it can be inserted into the duct **80** of the inlet port **76** of the pump **70**. An O-ring **95** fits around the first stem segment **96** and is used to seal the connection between the first stem segment **96** and the duct **80**, providing a leakage free direct connection between the socket **90** and the pump **70**.

Referring to FIGS. **3** and **5**, the socket body **94** is a solid cylinder having a front face **98** and a back face **100**. The stem **92** is molded onto the back face **100** of the body **94**. A plurality of pin holes **97**, extend between the front face **98** and the back face **100** of the body **94** and are spaced upon the faces intermediate a center and an outer surface of the body **94**. In a preferred embodiment, five pin holes **97** extend in parallel arrangement between the faces of the body **94**. Hollow, electrically conductive pin receptacles **99** are disposed within the pin holes **97**, one end in alignment with the front face **98**. The pin receptacles **99** continue through the body **94** and protrude beyond the back face **100**, external to the stem **92**. In a preferred embodiment, the protruding portion of the pin receptacles **99** are parallel to the stem **92** of the socket **90**. A sample flow hole **102** extends through the center of the body **94** from the front face **98** to the back face **100**, and continues through the stem **92** of the socket **90**, creating a continuous sample flow path from the front face **98** of the socket **90** to the duct **80** of the inlet port **76** of the pump **70**. The socket **90** is made of an electrically non-conductive, structural material. In a preferred embodiment, the socket **90** is made of plastic.

The collar **110** has a cylindrical portion **114** projecting from and centered upon a front face **116** of a generally rectangular plate **112**. An opening **115** extends from a front end **117** of the cylindrical portion **114** through the plate **112**. The edges of the plate **112** extend laterally beyond the outer surface **118** of the cylindrical portion **114** so that the opposite sides of the plate **112** engage mating channels **51** formed in the body **50** of the detector **40** as shown in FIG. **7**. The outer surface **118** of the cylindrical portion **114** is threaded. A thin washer (not shown) is disposed against the front face **116** of the plate **112** surrounding the cylindrical portion **114**. The collar **110** is made from a structurally sound material. In a preferred embodiment, the collar **110** is made of nickel-plated brass.

The socket body **94** is of the size to be inserted into the opening **115** in the collar **110** with the front face **98** of the socket body **94** in approximate alignment with the front end **117** of the cylindrical portion **114** of the collar **110** and the stem **92** protruding beyond the plate **114**.

Returning to FIG. **3**, the flexible interconnect **145** is a flat electronic cable for electrically connecting two electronic devices for sending and receiving signals therebetween. In the present invention, the flexible interconnect connects the sensing device **140** and the printed circuit board **150**. The flexible interconnect has a first end **143** and a second end **147**. As shown in FIGS. **6** and **7**, the first end **143** of the flexible interconnect **145** is affixed to the pin receptacles **99** protruding from the socket body **94**. The second end **147** of the flexible interconnect **145** may be removably attached to the printed circuit board **150**. The flexible interconnect **145** is external to the socket **90**, and hence external to the sample flow path, eliminating the obstruction in the sample flow path existing in the D-TEK and The Informant refrigerant leak detectors as discussed above. In a preferred embodiment, the first end **143** of the flexible interconnect **145** is soldered to the pin receptacles **99**.

Returning to FIG. **5**, a sensing device **140** suitable for use with the present invention is disclosed in U.S. patent application Ser. No. 09/838,169, filed on Apr. 19, 2001, and incorporated herein by reference. The sensing device **140** has pin receptacles **141** that can be inserted into the pin receptacles **99** on the front face **98** of the socket body **94**, thereby connecting the sensing device **140** to the printed circuit board **150** via the flexible interconnect **145**.

The probe **120** includes a flexible outer tube **121**, an inner tube **126** which may be formed from TEFLON®, a filter **128** and a probe tip **130**. The flexible outer tube **121** has a first bushing **122** at one end and a second bushing **124** at an second, opposite end. The first bushing **122** is threaded such that it may be removably attached to the cylindrical portion **114** of the collar **110**. The inner tube **126** is fastened to the first bushing **122** and is long enough to extend the length of the flexible outer tube **121**, terminating at the second bushing **124**. The filter **128**, preferably made of foam, is inserted into the second bushing **124** and rests on the inner tube **126**. The probe tip **130** is shaped like a funnel, with a first end **131** and a second end **132**, the first end **131** having a larger diameter than the second end **132**. The first end **131** is threaded so that it may be removably attached to the second bushing **124**. The second end **132** of the probe tip **130** has an opening so that an air sample can be drawn in through the second end **132** of the probe tip **130**, through the probe **120**, past the sensing device **140** and into the duct **80** of the inlet port **76** of the pump **70**. The probe tip **130** is made of a structural material. In a preferred embodiment, the probe **120** is approximately 14 inches long and the probe tip **130** is made of aluminum. One feature of the present invention is to have the probe **120** be a flexible goose-neck probe. Although a preferred embodiment of the present invention includes a probe **120** that is flexible, it is readily understood that a semi-rigid or a rigid probe may be used instead.

The sample flow path assembly **55** is constructed in two phases—first constructing and installing the internal subassembly into the body **50** of the detector **40** then attaching the external elements (i.e., the sensing device **140** and the probe **120**) to the internal subassembly. To begin construction of the internal subassembly, the pin receptacles **99** are press fit into the pin holes **97** disposed within the socket body **94**. The socket body **94** is then press fit into the opening **115** in the collar **110** with the front face **98** of the socket body **94** in approximate alignment with the front end **117** of the cylindrical portion **114** of the collar **110**. The first end **143** of the flexible interconnect **145** is soldered to the portion of the pin receptacles **99** protruding from the back face **100** of the socket body **94**. The O-ring **95** is fitted over the first stem segment **96** which is then inserted into the duct **80** of the inlet port **76** of the pump **70** sealing the connection between the first stem segment and the duct. The washer is placed around the cylindrical portion **114** and against the plate **112** of the collar **110**. The completed internal subassembly is then installed into one half of the detector body **50** which also holds the printed circuit board **150** and the controls, as shown in FIG. **7**. The second end **147** of the flexible interconnect **145** and the pump motor **72** are connected to the printed circuit board **150**. The other half of the detector body **50** is placed in position and the two halves of the detector body are fastened together, enclosing the internal subassembly, leaving an opening through which the front face **98** of the socket **90** and the surrounding cylindrical portion **114** of the collar **110** can be accessed. The sensing device **140** is pressed onto the front face **98** of the socket body **94**, the pins of the sensing device **140** engaging the pin receptacles **99** disposed in the body **94** of the socket **90**. The filter **128** is inserted into the free end **123** of the flexible outer tube **121** and the probe tip **130** is then threaded onto the second end bushing **124**, completing assembly of the of the probe **120**. The first end bushing **122** is threaded over the threaded outer surface **118** of the cylindrical portion **114** of the collar **110** and tightened, attaching the probe **120** to the internal subassembly of the sample flow path assembly **55**. The power supply is connected to the body **50** of the detector **40**, thus completing the assembly of the gas leak detector **40**.

Replacement of the sensing device **140**, as illustrated in FIGS. **9***a*–**9***d*, may be accomplished by detaching the probe **120** from the cylindrical portion **114** of the collar **110** (FIG. **9***a*), removing the installed sensing device **140** from the socket body **94** (FIG. **9***b*), pressing a replacement sensing device **140***a* onto the front face **98** of the body **94** of the socket **90**, making sure the pins **141** of the sensing device **140***a* engage the pin receptacles **99** disposed in the body **94** (FIG. **9***c*), and reattaching the probe **120** to the cylindrical portion **114** of the collar **110** (FIG. **9***d*). With a preferred embodiment, replacement of the sensing device **140** can be accomplished without the use of tools.

Likewise, the probe **120** may be replaced by detaching the existing probe **120** from the collar **110** and attaching a replacement probe. Again, in a preferred embodiment, the replacement steps can be accomplished without the use of tools. In like manner, the pump **70** and the socket **90** and collar **110** combination may be replaced.

Revisiting the requirements of greater sensing device sensitivity, shorter response time, shorter clearing time and reasonable battery life, the present invention has the advantages of a higher air flow rate, a more efficient sample flow path, and a short signal path between the sensing device and the printed circuit board.

The present invention has a sample air flow past the sensing device at a flow rate in excess of 300 SCCM, which is at least six times greater than the flow rate of "The Informant" and almost an order of magnitude greater than the flow rate generated in the D-Tek. Further, unlike the Top Gun detector, the sample flow path of the present invention subjects the sensing device to the full, high, flow rate, thereby significantly increasing the sensitivity of the sensing device and reducing the clearing time. While the present invention has a sample path length (the distance between the opening in the probe tip and the sensing device) similar to or longer than the other detectors, especially those that position the sensing device in proximity to the probe tip, the present invention nevertheless provides a much more efficient sample flow path because there are no wires within the probe to obstruct the flow path (D-TEK and The Informant) and the sensing device is placed in direct communication with the inlet side of the pump (as opposed to the D-TEK, The Intimidator and the Top Gun), thus shortening the distance between the sensing device and the pump, which among other things, eliminates the need to clear out the pump before another sample can be taken. The increased flow rate past the sensing device provides a greater sensing device sensitivity, a reduced response time and a shorter clearing time. In addition, the relatively short distance between the sensing device and the printed circuit board, especially compared to the D-TEK and The Informant, reduces the electrical resistance of the connecting wires which reduces the demand on the battery.

The present invention has an advantage in having a sample flow path assembly that is easy to manufacture, thus reducing the time and costs associated with manufacturing the gas detector. The flexible interconnect between the sensing device and the printed circuit board is short and is exterior to the flow path, eliminating the need to insert lengths of wire through a small diameter flexible tube. In addition, the placement of the flexible interconnect exterior to the flow path eliminates the need for sealing the flow path with either rubber plugs or flexible sealant. The individual components of the sample path assembly are either threaded or press fit together. The flexible interconnect requires soldering only at the sensing device. Tubing inside the detector body is eliminated because the only "tubing" interior of the detector body is the socket stem that directly connects the socket holding the sensing device and the inlet portal of the pump.

In addition, the sample flow path assembly of the present invention is advantageous with regard to maintenance issues. The location of the sensing device at the base of the removable probe allows for easy access and replacement. Additionally, if the probe is damaged, it can be easily removed and replaced. Finally, many of the remaining components of the present invention are modular, which makes replacement of any one component relatively easy. Thus, the present invention provides a more reliable and cost effective gas detector.

It will therefore be readily understood by those persons skilled in the art that the present invention is susceptible of broad utility and application. Many embodiments and adaptations of the present invention other than those herein described, as well as many variations, modifications and equivalent arrangements, will be apparent from or reasonably suggested by the present invention and the foregoing description thereof, without departing from the substance or scope of the present invention. Accordingly, while the present invention has been described herein in detail in relation to its preferred embodiment, it is to be understood that this disclosure is only illustrative and exemplary of the present invention and is made merely for purposes of providing a full and enabling disclosure of the invention. The foregoing disclosure is not intended or to be construed to limit the present invention or otherwise to exclude any such other embodiments, adaptations, variations, modifications and equivalent arrangements, the present invention being limited only by the claims appended hereto and the equivalents thereof.

What is claimed is:

1. A gas detector for sensing the presence of at least one predetermined gas comprising;

a device means for sensing at least one predetermined gas;

means for supplying a sample air flow to the sensing device at a flow rate exceeding about 300 SCCM;

means for disposing said sensing means within the sample air flow path between the pump and the probe, wherein the means for disposing the sensing means within the sample air flow path is a socket connected to an inlet port of the pump and a collar surrounding the socket, the sensing means being supported by the socket and the probe connected to the collar.

2. The gas detector according to claim **1**, wherein the means for sensing at one predetermined is a sensing means device selectively operable with a controlled temperature, a controlled bias current or a combination thereof.

3. The gas detector according to claim **1**, wherein the means for supplying a sample air flow has a maximum flow rate of about 400 SCCM.

4. The gas detector according to claim **1**, wherein the means for supplying a sample air flow.

5. The gas detector according to claim **3**, wherein the means for supplying a sample flow includes a means for generating an air flow in communication with a probe via a sample air flow path.

6. The gas detector according to claim **5**, wherein the means for generating an air flow is a pump.

7. The gas detector according to claim **6**, wherein the pump is a diaphragm micro-pump.

8. The gas detector according to claim **5**, wherein the probe is a flexible goose-neck probe.

9. The gas detector according to claim **6**, wherein further comprising means for disposing said means for sensing within the sample air flow path between the pump and the probe.

10. A gas detector, operative in conjunction with a power source, for sensing at least one predetermined gas, the gas detector comprising:

a sensing device capable of sensing at least one predetermined gas;

a sample flow path assembly for supplying the sensing device a sample air flow at a flow rate exceeding about 300 SCCM, wherein the sample flow path assembly further comprises a pump in communication with a probe via a sample air flow path, a socket connected to an inlet port of the pump and a collar surrounding the socket, the sensing device being supported by the socket and the probe connected to the collar, wherein the pump has a manifold integral to the pump, and has the inlet and an outlet port disposed on opposite sides of the manifold.

11. The gas detector according to claim **10**, wherein the sensing device is selectively operable with a controlled temperature, a controlled bias current or a combination thereof.

12. The gas detector according to claim **10**, wherein the sample flow path assembly supplies the sensing device a sample flow having a maximum flow rate of about 400 SCCM.

13. The gas detector according to claim **12**, wherein the sample flow path assembly supplies the sensing device a sample air flow having a flow rate between about 350 SCCM and 400 SCCM.

14. The gas detector according to claim **10**, wherein the sensing device is disposed in the air flow path between the pump and the probe.

15. The gas detector according to claim **10**, wherein the pump is a diaphragm micro-pump.

16. The gas detector according to claim **10**, wherein the gas detector further comprises a housing and wherein the probe extends beyond the housing.

17. The gas detector according to claim **10**, wherein the probe is a flexible goose-neck probe.

18. The method for sensing the presence of at least one predetermined gas with a gas detector, the steps comprising:

monitoring a sample air flow with a sensing device, the sensing device comprising a sample flow path assembly that comprises a pump in communication with a probe via a sample air flow path, a socket connected to an inlet port of the pump and a collar surrounding the socket, the sensing device being supported by the socket and the probe connected to the collar, wherein the pump has a manifold integral to the pump, and has the inlet and an outlet port disposed on opposite sides of the manifold; and

supplying the sample air flow to the sensing device at a flow rate of at least 300 SCCM.

19. The method according to claim **18**, wherein the step of monitoring a sample air flow includes the step of controlling the sensing device to selectively operate with a controlled temperature, a controlled bias current or a combination thereof.

20. The method according to claim **18**, wherein the step of supplying the sample air flow includes the step of supplying the sample air flow to the sensing device at a maximum flow rate of about 400 SCCM.

21. The method according to claim **20**, wherein the step of supplying the sample air flow further includes the step of supplying the sample air flow to the sensing device at a flow rate between 350 SCCM and about 400 SCCM.

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